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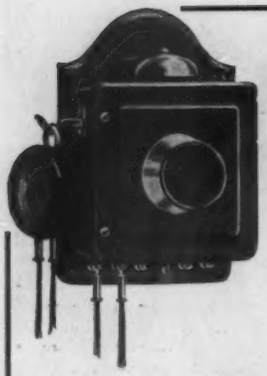

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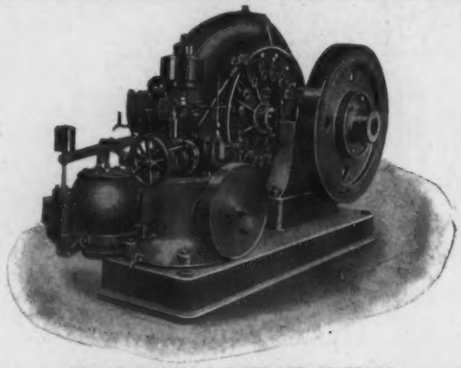

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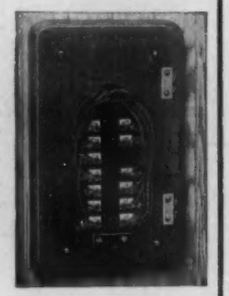

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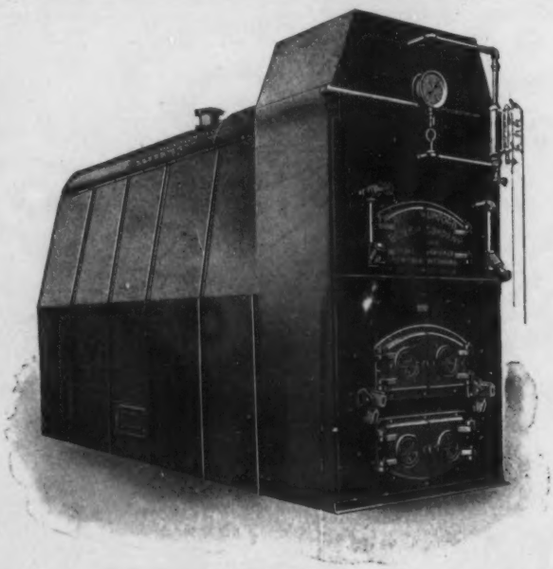

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THE LIFE HAZARD AND RESUSCITATION IN ELECTRICAL ENGINEERING

BY CLEM A. COPELAND.

THE vast ramifications of electrical transmission and distributing systems and their remote extensions at high voltages, the overlapping and interlinking of competing properties, and the immense amount of reconstruction made necessary by rapid advances in the art, are tending to make the life of the electrical engineer one of correspondingly increasing danger.

Nor is the public exempt from the penalty of rapid progress, many lives being sacrificed annually on the altar of an art which has not lived up to its responsibilities in the protection of life and property. During the latest period of greatest activity, there were from 300 to 400 deaths per year from electrical causes in the United States.

On account of the contempt bred of familiarity, it is little appreciated that the electrical situation in Los Angeles is probably of the most complicated of any extant. Fostered by the growth from a population of 100,000 to one of 325,000 during the last ten years, and the resulting keen competition of seven power distributing corporations, and two telephone companies, there has developed so many intermeshing systems of various kinds and voltages covering identical territory, that the air is literally full of copper and danger. Not only is the place appropriate, but the time has long been ripe for a discussion of this subject, and we may well pause in a period of comparative quiet to consider the best methods for the protection of the employee and the public during the future years when the specter of an eighth power distributing concern clouds up over the Tehachapis and the scent of a third telephone company is in the air.

These conditions demand that a broader education of the corporation, the employee and the public should ensue, so that safer methods of construction, better means of avoiding accidents, and improved ways of helping the injured will be more widely known and practiced.

It is the function of this paper to discuss the sources of danger and causes which lead to injury, the means necessary to prevent or correct them, and the method to pursue in case of injury from electrical shock.

The most common sources of serious accidents may be enumerated thus:

First—Shocks which the electrical artisan receives due to his carelessness, or that of his co-worker, either on the line or in the station.

Second—Shocks which he receives due to imperfections in construction of the line or station which are not avoidable by diligent care on the part of the one injured.

Third—Shocks which the public, innocent of danger receives from outside line construction.

Fourth—Shocks which the innocent public receives from inside wiring installations.

By furthering means for the elimination of carelessness and lack of knowledge of danger on the part of the engineer, the corporation and the general public and its employees, and by a proper study and introduction of improved methods of construction and resuscitation, surely nine-tenths of all injuries may be avoided.

Of all electrical positions, that of lineman is undoubtedly the most dangerous from the standpoint of his own carelessness and that of others, and from the standpoint of poor construction, and lack of education in these matters, both of the company and himself.

On account of hasty judgment, we are apt to blame the lineman entirely too much for accidents which occur. Daily contact with extreme danger from an invisible and innocent appearing agency breeds involuntary carelessness. Moreover, if we were all as careful as some, there would be a serious lack of new material.

It has, however, been to me a matter of continual

marvel, that the vast majority of linemen know absolutely nothing about resuscitation, and I am not sure but that this applies to other classes of electrical workers. The fault is more blamable, however, in the most dangerous positions.

Telephone linemen are the most careless class of all electricians. This is the natural result of these companies employing men who have never worked with voltages over 50, and amperages above unity, to work amongst circuits of 2000 to 30,000 volts or more without any knowledge of them, or without taking the intermediate steps.

Thus we find a man in Redlands dragging a bare telephone wire over a bare 10,000 volt line. That he escaped with his life and nine fingers, seems one of those curious freaks of Providence which is not within the scope of this paper to discuss. His excuse, that he supposed it to be an ordinary 2000-volt lighting line, is equally interesting.

The most annoying thing about these matters is, that our own safety depends not only on our own care, or carelessness, but on that of co-workers. A false move of one man destroys the safety of many.

A commendable remedy to keep linemen from being careless is for the company physician or superintendent, or both, to make trips around the system once per year at least, preferably every six months, and give a demonstration to every "outside" employe as to how to resuscitate a person and call to their attention the various means of precaution against shocks in the first place. The moral effect of this is to make the men more thoughtful, careful and intelligent in these matters. This should apply to telephone companies as well as power distributing concerns.

Every new male employee should have a medical examination and a thorough instruction in resuscitation before assuming his duties. The corporation would thus widely disseminate valuable information for which it would be recompensed an hundred fold, as well as do a substantial service to the profession.

A most common cause of accidents to the public is due to a cross between primaries and secondaries of lighting transformers which may result from defective insulation, throwing the responsibility on the manufacturer or the elements, or a cross on the wires leading to and from the transformer, in which case the distribution engineer may be blamed. As an instance of the latter a man lost his life by turning on a lamp in a stable while standing on a dirt floor. His heirs were awarded $5000 damages, which caused a prominent company to remodel many hundred transformer hangings and adopt new and improved methods of distribution.

Those of us who have kept special note of accidents along these gruesome lines will recall several similar cases. In fact this is the most prolific source of public danger, and will be further discussed below.

In this discussion, it is pertinent to ask what voltage will kill a person. One may as well ask how many pounds falling on the head will prove fatal. It may be ten ounces or ten pounds, depending on how good a start the weight had before it lit upon the head in question, and to some extent on the head.

I know of an example of the very common case, mentioned above, in which a middle aged, but quite hardy man was severely shocked by turning on an incandescent lamp while in the bath. I suppose Prof. Hoskins of Stanford University would have no objection to my giving his name in this connection. The shock was a rough one, and caused him trouble for several weeks I went twice to measure the pressure the next day. It was 27 volts.

I remember the painful shocks, leaving a taste in my mouth, which I used to receive while repairing a 110 volt d. c. two-wire system cable in a wet shaft in the Copper Queen mine, at Bisbee, Arizona, years ago, even when protected by rubber gloves and an umbrella. To have grasped these wires if bare, while the hands were saturated with the copper sulphate waters of the mine, would have undoubtedly proven fatal.

Perhaps some will remember of the death of a Stanford student, Mr. Jossselyn, in 1899, who was killed on a 110 volt circuit. On the other hand I know of three persons shocked by 33,000 volts, one by 15,000 volts and I think there are cases of direct ground shocks on 60,000 volt lines, which have not proven fatal, while I know of a dozen deaths from 2000 volts in this city alone. I have talked with many on this subject, and although we would not advise toying with voltages as high or higher than 30,000, yet it seems that they are as safe or safer than say 2000 volts. The higher voltages seem to vent their energy on the surface of the body, instead of within. A sort of "skin effect," as applied to a human conductor.

Along this line there is a curious argument which I have lightly made when our municipalities berate the presence of voltages above 2000. I have often maintained that high voltages, say 5000 to 30,000, were less dangerous to life than 2000; on still another account from that mentioned above. Almost every electrical worker knows the looks of a high voltage line with its large insulators and bare menacing wires wide apart. He keeps a correspondingly safe distance, and no one ever pretends to work on them while they are "hot," and therefore, accidents on them seldom occur. Furthermore high voltage lines are usually constructed with more care than the so called less dangerous or low voltage ones.

With reference to the means to be adopted to prevent injury to the public when turning on incandescent lamps, there is the chance to revive the oft discussed topic of grounding secondaries of lighting transformers, and I venture to advance a few arguments along this line which seem to have been neglected.

In the first place grounding the secondaries does not entirely remove the danger, for as we have seen above, and we may see from studying many cases, 100 volts may prove fatal, and there is no good reason for disputing that it might thus increase the danger, as it would put a positive ground on the system, enabling one to get 100 volts by turning on a lamp instead of say 27, as in Prof. Hoskins' case. One hundred volts in this case would surely have proven fatal to a life which the engineering world could illy spare.

Moreover, we put the large iron box on the pole and the labyrinth of secondary wires on a dead ground to the 2000 volt primaries in a most remarkably handy place for the linemen already too hampered with danger. I have maintained practically alone in this matter, that we thus endanger more lives than we protect.

In all arguments which I have ever come across, the safety of the lineman has been entirely neglected.

Therefore, I claim that no matter whether the secondaries are grounded or not; the true remedy lies in the passage of a city ordinance preventing any power supply company from connecting up to any wiring installation in which one may without extraordinary effort touch an electric light, or switch, and at the same time touch any ground, such as a bath tub, wash-basin, telephone, or other signal system or apparatus, cement or dirt floors, gas or water pipes, or grounded metal ceiling, or framing, unless a ground-proof or shock-proof switch be installed.

Architects, plumbers, wiremen, telephone and other signal companies would then govern themselves accordingly, and many lives annually would be saved, such as that of Gilbert Ayrton, at Bakersfield, on October 4th, last, who met death by turning on a lamp while washing a buggy in a stable. This case should not be confounded with a similar one mentioned above, and may prove the fatality of 100 volts under favorable circumstances, as well as the importance of proper regulations as described above.

In the passage of such a measure, I would not say that an ordinance should or should not also be passed, compelling companies to ground secondaries. We now have 75,000 wiring installations already in use in Los Angeles, and there is probably not one of them in which a person could not easily touch an incandescent lamp and some ground. It is of course impossible to remodel all of these installations, but surely the ordinance above mentioned regulating interior wiring should be passed for future installations; at any rate, for reasons above cited, whether secondaries be grounded or not.

The attention of civic bodies should be directed to the particulars of outside transformer installations as well, and an ordinance should compel companies in all future work to hang transformers with primaries and only the primaries above the transformer on a separate arm while the secondaries would be specified to go underneath. In remodeling present construction in which primaries and secondaries are run on the same crossarms as a general rule, the secondaries should dip down under the transformer at the transformer pole. Ten years construction in Los Angeles has proven the wisdom of such a method. As mentioned below, it is my opinion that primaries and secondaries should never be placed on the same arm, arc circuits being considered as primaries.

It is not the province of this paper to go into details of line construction except in a broad general way but the ordinance embracing the above rules should also include the following regulations as remedies for many other ills.

The ordinance should specify that:

All transformers setting on the ground or floor, or hanging within ten feet of the ground have their cases grounded.

All secondary instruments on high tension work in stations, or elsewhere must be grounded;

All frames of generators and motors in stations or private installations must be grounded;

All generators and switchboards in stations must be surrounded by suitable insulated platforms;

All guy wires on 2000 to 5000 volt work must have strain insulators about six feet from the pole, and must either pull from an eye-rod in the ground, or be grounded by proper methods if pulling from a guy stub, so that the public, as well as linemen, would be protected from shock. I have heard of two serious accidents from neglect of this rule.

On all high tension lines guy anchors only must be used.

All steel poles if set in cement must be additionally grounded by approved methods.

All high-tension-line telephones, especially, and in fact all telephones, private or public, should be installed so that the party using same is thoroughly insulated from all grounds.

The ordinance should compel all telephone lines to pass under lighting lines, or be separated by a proper and approved guard. In joint pole work, lighting lines should be placed above telephone lines in all cases. I can recall two deaths from disregard of these rules.

The city ordinance should compel all high tension lines to pass above all others.

All pole pins on any cross-arm of either lighting or telephone construction must be at least fifteen inches from the center line of the pole.

It should also specify that:

No wires carrying more than 110 volts should be allowed to run over a roof where anyone could stand, and touch them either deliberately, or in case of catching at them in slipping.

The ordinance should prevent any man, lineman or troubleman from climbing a pole—either lighting or telephone—who has not passed an examination in the matters of this paper.

The ordinance should prevent any person from engaging in the dangerous side of the profession without proper examination, both as to the contents of this paper, and as to physical qualifications.

These regulations should be the forerunners of laws, which should be passed by every State legislature in the Union.

Another great advantage is, that such ordinances and laws, if we properly push them hard lead to a higher dignity of the profession, and a higher appreciation of the dangers in which we work, both from the standpoint of public and corporation recognition.

There is a very serious defect in our present system of inspection by the National Board of Fire Underwriters which would also prove a defect in case such an ordinance as this was passed. A small protoplasm of a town begins to develop very shortly into a California "city." The first buildings were not wired. Now there are rumors of the town being lighted by electricity and some culprit with no conscience to speak of commences to wire the town. It is therefore done with no inspection in a most shameful manner so that when the town has grown to the dignity of appointing a city electrician or an inspector he finds himself with a criminally liable set of junk on his hands upon which some one is often getting hurt or which is the cause of numerous fires. There are many glaring examples of this perplexing fault in Southern California. State inspection and the requirement of a State license to wire houses seems to be the only remedy.

Such measures would put line construction under similar civic supervision to that of interior wiring installations, which is highly reasonable.

It seems a very curious condition, which in our more or less heartless business system, certain laws, such as the National Board of Fire Underwrtiers' rules are now enforced by every city to protect structures against fire, and yet none are enacted to protect the human frame against the potent agency. This is almost a criminal fault which should be corrected.

Other rules which should be enforced by the companies themselves and which are little less important than those above are as follows:

A rule should be passed by every company that all reels, either pay-out or take-up should be of iron and set on the ground when in use, and additionally grounded by means of an iron pipe driven into the ground, and connected to the reel by means of flexible cable. The wire on the reel, if insulated should be grounded. I know of one life lost and three injuries to as many men which occurred by the neglect of this precaution.

Rules and blue-prints should be gotten out, so that lines would be properly guyed, especially at the corners. This is one of the most neglected arts in line work, and many accidents are caused by poorly guyed lines sagging down upon others.

All high tension lines must be shorted and grounded by a chain attached to an iron pin for driving into the ground whenever being worked upon.

All linemen should be required to use rubber gloves and "safeties."

In pulling in or out wires, hand lines should be imperative. I know of one case in which three men were seriously shocked, one of whom died from the neglect of this precaution.

In house moving or emergency work, no poles should be allowed to stand an abnormal strain without being temporarily guyed. Due to the peculiar way in which poles decay here it is especially impossible to tell whether a pole is safe. I know of one life lost by neglect of this precaution.

By the way, house-movers used to be quite prolific causes of accidents, but they are growing more wise as time goes on. I know of one instance in which a house mover carefully guided a dwelling under a live 10,000 volt circuit with marked success. If it had not been that dry houses in the summer atmosphere of San Bernardino are good insulators, he might have been more than tickled to death to think that he had finished the job before the line foreman showed up. I think that house movers are now automatically protected by city regulations.

Finally every member of the profession should assist in introducing the customs following:

In all civil service and university examinations there should be questions asked which will show whether the man is familiar with these matters, and if not, he should not be allowed to pass until he has mastered them, no matter how efficient he may be in other lines.

I have been privileged to examine perhaps a hundred linemen together with other electrical men for civil service positions. I have always inserted some such questions as the following: Suppose one of your fellow workmen should suddenly fall over shocked apparently to death while working on a 2000-volt line. "Tell accurately, and in detail, just what you would do."

I wish I could read you some of the answers here tonight, but it is sufficient to say that 90 per cent of the answers were radically wrong. Out of one batch of 19 papers, only one seemed to understand what to do.

I would especially urge that all universities see that their graduating engineers are familiar with these important matters before graduation. They are woefully lax in this regard, and I doubt whether the majority of university engineering graduates can even spell "resuscitation."

In view of the fact that an electric shock from any voltage whatever is simply a case of suspended animation due to lack of circulation. i. e., a sort of "stunning" of the heart and lungs as it were, these matters are very important, and we will now pass to a consideration of methods of

Resuscitation.

The method to pursue in case one seems mortally shocked by electricity differs only from resuscitation in case of drowning in that the lungs need not be drained of water. Furthermore the person shocked often swallows his tongue, sometimes rendering resuscitation difficult, which does not occur in the case of drowning.

The two great and most important factors in electrical resuscitation are:

First—Promptness.

Second—Continuity of performance.

I think that within reasonable bounds the method is subordinate, and I am satisfied that more deaths have occurred from lack of knowledge on these two points than from the actual shock itself, or from lack of knowledge of a method. It seems very probable that all deaths could be prevented by prompt and long continued methods where the shock has not effected a vital wound, or an actual disintegration, or change of vital tissue.

I have already mentioned the case in which three men were terribly shocked by 33,000 volts due to pulling in wires without a hand line. One man died as a result of the rest of the party getting "rattled," one man came to life as the result of being badly jolted in an express wagon on the way to the doctor, while the third was saved by a stableman with characteristic "horse sense," who rushed to the aid of the third and resuscitated him by kneading his breast with his knee. These are two cases showing that promptness is subordinate to method.

I know of a similar case in San Francisco, in which a man was grounded on an arc circuit. His face turned black immediately, but he came to, while being bounced over a rough road to a drug store; and it seems quite likely that it was the jolting which saved his life. I would further cite the case where a man was shocked in this city by 15,000 volts behind a switch-board in a very bad place to work on him. His associate did not yield to the temptation of removing him, but recognizing the value of immediate means, he was worked upon right where he fell without calling for help, as none was near. He was resuscitated in

fifteen minutes, showing the value of promptness, while the method in this case was used by one who to my personal knowledge had been well drilled.

On the other hand I know of seven cases in which men have died in this city undoubtedly due to a lack of observance of the above points. I believe I am safe in saying that 75 per cent of all deaths from shocks could have been prevented by promptness of performing some method, and half of these are due to lack of any knowledge of when and what to do by co-workers of those shocked. The other half are due to disturbing the patient while being worked upon to put him in the emergency wagon when he is whisked away to the hospital, and of course dies on the way. There is little chance of properly or continually working on a man in these close wagons, and I do not think there are any here tonight who can cite an instance of a man being saved by such a means. He may have revived in spite of it.

In the "Journal of Electricity, Power & Gas" for October, 1902, page 195, you may find the following note by Mr. Lighthipe:

> Sometime ago there was a man tied up on a pole on the corner of Eddy and Mason streets (San Francisco) with a great crowd around him, and four or five policemen guarding the bottom of the pole waiting for the ambulance to come. They finally did get the man on the sidewalk and there he lay and they would not let anybody get near him. Although I tried to get to him and told them who I was, I was fired out of the crowd quicker than if I had said nothing. He lay there by actual count, twenty minutes, before the patrol wagon came and carted him away to the city hall, where he was pronounced dead. * * * * The policemen immediately assumed that the man was dead because he was motionless.

The remedy is patent. Those having the direction of emergency wagons should be instructed as to how to work on those shocked, and they should be instructed not to remove one being properly worked upon when the wagon arrives, or they should know how and take charge of resuscitation on the spot without removal in case they are not being worked upon properly, or at all.

First—Chop wires with hatchet on block of wood, or pull man off circuit by coat-tail or loose clothing, not by his shoes for they have dangerous nails. Clothes next to his body are not insulators on account of perspiration, so look out and don't get shocked yourself.

Second—Tear off any obstructions around throat, as collars or handkerchief, shoulder-braces, or suspenders, and loosen clothing. Don't expose the breast any more than necessary. Heat of the body should be conserved as much as possible to help circulation.

Third—Put him in such a position that his head is lower than his feet if possible and handy.

Fourth—If you are the only one present to resuscitate the man, don't send for anyone, or anything, but do it yourself quickly, and don't get "rattled." Lay man on his back and commence resuscitation method immediately, right where he falls, and don't miss a lick until he is revived, if it is possible to do so, and don't let anyone remove him to new location. Every fraction of a minute is valuable; one does not know what second life may be come extinct.

Fifth—Extend arms back over the head in the plane of the body and then bring them down forward

Fig. 1. Arms being extended back over the head in the plane of the body (see Fifth Note of paper) and knees being pressed up towards the breast (see Eleventh Note of paper).

Fig. 2. Arms fully extended back over head, knees up to breast.

Fig. 3. Arms being brought down forward over the chest.

Fig. 4. Arms compressing the chest at lower ribs to expel air (see Fifth Note of paper); limbs extended.

over the chest and compress the chest at lower ribs, repeating the process deliberately about sixteen times per minute to duplicate natural breathing.

Sixth—You should hear air freely issuing from throat when ribs are compressed. If not throat is probably plugged with tongue. Stop long enough to force open mouth with pliers or stick of wood (not your fingers, you may be bitten and delayed). Then pull tongue out a ways with handkerchief or pliers, stick a pin, safety pin or piece of wrapping wire through it to hold it out, then commence resuscitation method.

N. B. (a)—Don't put fingers in mouth unless it is blocked open.

N. B. (b)—Rigidity or resistance to the resuscitation method is a good sign.

N. B. (c)—Vomiting is also good sign, but you will have to clean out throat a little with fingers or it may obstruct breathing. You might have to turn man over on face for an instant and lift up waist of body to drain his throat. Return to resuscitation method as soon as possible.

Seventh—If there is one other man present get him to roll up a coat and put it between the shoulders. If a coat is not handy take a block of wood, or a flat stone, but don't let them interrupt your resuscitation method.

Eighth—Also get him to force open his mouth and draw his tongue out a little ways, as explained in sixth note above, keeping throat clear, etc., etc.

Ninth—Then also get him to run to nearest house if not more than a half block away and get blankets to cover him up with so as to conserve heat of body. Warm weather may be uncomfortable for those working but is favorable to the man shocked.

If shocked in freezing or snowing weather it may be advisable to take him into a warm house if very near by, in violation to fourth note or instruction above.

Tenth—If there are two present to help, send one for a doctor with an oxygen tank if possible. It is not necessary to send for the emergency wagon until he shows signs of life.

Eleventh—Have one or two of your helpers lift up legs, bend them at the knees and press the knees up towards the breast, then bring them back down and straighten them out. Perform this in unison with the resuscitation method so that the knees follow the arms back and forth.

Twelfth—Don't give up working for three hours at least. Four may be long enough, especially if eyeball is very soft, and body is cold. Compare your own eyeball with the injured man's. Do not stop as long as the eyeball is hard.

Thirteenth—Don't try to administer whisky or water or anything else until the man is revived and stands up or sits up.

Following the above paper Drs. Johnson and Stinchfield of the Southern California Edison Company, assisted by efficient helpers from the line department of the company, gave a thorough demonstration of the method of resuscitation as shown in Figs. 1, 2, 3 and 4.

Dr. Milbank Johnson earnestly seconded Mr. Copeland's paper, expressing the opinion, based on many years experience with men shocked on 460, 2000, 10,000, 15,000, 30,000 and 60,000 volts, that 2000 volts or thereabouts was the most dangerous to life and caused fully as destructive burns.

The question of fireproof clothing for electrical workers was also considered. Most of those shocked being very severely burned, not only by the electricity primarily but by burning clothing ignited by the arc, secondarily, causing excessive skin grafting. He urged that the groundman receive the same consideration as the lineman. His is a dangerous position and being of less business importance is often forgotten. The grounding of reels mentioned by Mr. Copeland is a partial protection.

He should be instructed as to resuscitation the same as linemen. In fact every "outside" employee and as many "inside" men, as possible, should be instructed by company physicians every six months at a "demonstration" and they should all participate and a statement signed by every such employee should be returned to the president of the company, stating that he had participated in the demonstration and was familiar by actual performance with the methods of resusciation.

Fig. 5. Newly proposed method.

Dr. Johnson stated that the auxiliary treatments often mentioned, such as forcible stretching of the sphincter muscle, or applying to the face or breast alternate hot and cold towels, or dashing cold water in the face, are inadvisable and only hinder the important parts of the process of resuscitation.

Dr. H. C. Stinchfield told of a new method, following along the lines of the "horse sense" method of the stableman of Redlands mentioned by Mr. Copeland. The position of the hands is shown in Fig. 5, the hands being spread out wide, grasping the lower ribs while the base of the hand rests on the diaphram. Deliberately but powerfully this part of the body is alternately pressed inward and at the same time upward toward the heart, and then slowly released. This is repeated deliberately 16 times per minute to duplicate breathing as before, while the limbs are elevated as much as possible.

Note.—This is a good method to use while your helper (see eighth note above) is drawing the tongue out as in sixth note above. Also as an alternative to rest with, as resuscitation is a very tiresome process.

RUBBER SITUATION IN BRAZIL.

Fluctuating Prices May Be Controlled by Plantation Output.

Consul-General George E. Anderson, of Rio de Janeiro, says that the movement of Brazilian rubber at the beginning of the present season of 1909-10 is under conditions which have had no parallel in the trade for many years, if ever before. Mr. Anderson discusses it as follows:

The exports of Brazilian rubber for the year ending June 30, 1909, were almost exactly the same as those for the year ending June 30, 1907, and yet the value of the exports of Brazilian rubber in the past year was about 120 per cent of the value of the crop in 1906-7 and about 187 per cent of the value of the exports in 1907-8. The entries in Brazil, as measured by the entries at Para, were 38,003 tons in 1906-7, 36,650 ton in 1907-8, and 38,065 tons in 1908-9. Of the shipments for the past year 19,200 tons were for Europe and 19,050 tons for the United States, the stock on hand therefore having been drawn upon to some extent. The visible supply of Para rubber at the beginning of the present season is placed at 3,132 tons, as compared with 4,634 tons at the same time the year before.

The value of the rubber shipped during the past year measures prices for the product which have been without precedent, the range of prices in the past two years being greater than that measured by a similar product in the same time within modern commercial history. In February, 1908, rubber was quoted at about 66 cents per pound. In July, 1909, before the crop season closed, prices were $2.10 per pound. High prices have been charged for the rubber stock since last November, but the prices did not go above $1.50 per pound until the two last months of the year. It seems to be generally agreed that prices will remain high during the current season. In the first place, it is understood that certain interests have combined to maintain the price. In a general way, also, with products like rubber, which at present depends more or less upon supplies from forest sources, it requires about a year to readjust supplies to demand after there has been an oversupply and a reaction which led to an undersupply. While there is prospect of high prices for the immediate future, and probably for the current crop season, such high prices will doubtless stimulate production and lead to a reaction the other way, which is likely to bring very low prices another season.

The chief element in the situation, however, which is likely not only to lead to lower prices, but also is reasonably certain to bring about regularity in supplies, and therefore a more permanent price range, is the plantation rubber supply. The supply of rubber from plantations in the Far East during the current year is placed at 4000 tons by practically all authorities. The actual present acreage in rubber plantations in the East at present is placed at from 520,000 to 600,000 acres. The rubber production from such plantations, as they come into bearing, is placed generally at about one ton of rubber to 10 acres of plantation. The immediate supply from such source—a supply to be fully realized in the course of three or four seasons—will unquestionably reach from 60,000 to 70,000 tons, or substantially the equivalent of the present world supply.

If the demand for rubber increases at the present rate the world ought to be consuming in, say, 1914, about 105,000 tons. What the total world production will be at that time is of course problematical, but it looks as though plantations would be producing more than enough to supply the world market. Such supply will be reasonably regular, will be based upon a known cost price, and it is quite evident that there will be no occasion for the immense variations in price which have characterized the rubber market for the past two years in a way to not only carry many losses to manufacturers, but also to embarrass them in manufacturing for a market even near at hand.

In the meanwhile the rubber plantation business has become so very prosperous that its prosperity carries danger with it. There is strong probability that the magnificent dividends paid by rubber plantation companies the past two years will lead to too great an extension of acreage. Speculation in companies organized for rubber planting would be particularly dangerous at the present time.

Moreover, while there has been great success attending rubber planting during the past season, it by no means follows that plantations will have the same success when wild rubber forests now known and only waiting to be developed along modern lines by their owners are opened up in the course of the next two or three years. The plantation rubber seems to have failed to meet demands in lines of manufacture in which strength is required, and many manufacturers declare that plantation rubber can not stand against wild rubber, except for limited purposes. Too great an extension of plantation investments, therefore, is likely to be disastrous from the standpoint of ability to sell the product.

The probability that plantation rubber will soon dominate the rubber market of the world so far as quantity is concerned is commencing to be appreciated in Brazil, but as yet few steps have been taken to avoid possible results in this line. Several of the state executives in annual messages have called the attention of their rubber producers to the situation and its unfavorable possibilities, but practically no action has been taken with a view of combating plantation rubber on a plantation basis. It seems probable that instead of planting rubber groves in Brazil and cultivating the rubber tree as it is cultivated in the Far East, the only result of the plantation movement in Brazil will be that new rubber forests will be opened up and that the rubber business will be managed upon a more modern and less wasteful plan. There is no doubt, if the rubber forests of the Acre Territory and of the State of Matto Grosso are opened up on a modern business basis, if the middleman is done away with; and if, in short, the wild forests are worked as far as possible in the same way as a plantation is worked, that the rubber business of Brazil will continue to dominate the rubber markets of the world. The wild rubber is a better quality, is from trees of great age and immense bearing capability, and is from a forest already established.

STEEL TOWER SUPPORTS VS. WOOD POLE SUPPORTS.[1]

BY S. L. FOSTER.

As the voltage has increased with increased length of transmission, the size of the insulator and the size of wood crossarm to support it has been increased until this old form of construction has become unwieldy and not altogether safe when the danger of burned off wood arms and poles are considered. The substitution of iron for wood pins removed the pin-troubles but not the crossarm troubles nor the pole troubles.

The first logical step in furnishing incombustible crossarms and poles in place of the perishable wooden ones of former classical practice was to use a steel pole with steel crossarms, mounting the old form of supported insulators upright on upward pointing iron pins. The bad results of this construction on the first steel tower line was that in a country where lightning storms prevailed, Guanajuato, Mexico, the steel pole acted as a lightning arrester and as the insulator was the highest point, it was often shattered by the lightning.

By substituting a form of insulator suspended under the steel crossarm of the tower the lightning naturally struck the steel of the tower or a cable strung from tower top to tower top in preference to the insulator.

When using wooden poles the length of span was limited by the length of poles procurable, whereas the length of span can be made anything reasonable when using steel towers, as these towers can be built of any reasonable height. With the new convenient form of suspension insulators and with 10 feet of vertical separation between conductors, the use of wood poles for even ordinary spans is out of the question when ample clearance between lowest conductor and foreign wires or even the earth is maintained.

In the wild country through which long distance transmission lines are usually run there are frequent grass fires that are liable to burn off wood poles at the ground. Occasionally nearby forest fires jeopardize the whole pole when of wood. The steel pole is practically invulnerable to such attacks in its cleared right of way. The metal is galvanized, insuring it against corrosion. The surface is smooth thus giving no hold for the claws of coons or cats in climbing and preventing a class of short circuits that have happened more than once on wooden pole construction.

The suspended form of insulation construction is built up of a series of insulator units connected together by hooks and eyes. Each disc-shaped unit has a mechanical breaking strength factor of safety of from 25 to 50 even after all the flange has been broken off. In case of a broken or burned off conductor this reserve strength in the insulator would take care of the unusual strain and not result, as sometimes occurs with the old style insulator and the wood crossarm, in a broken insulator or a split crossarm.

The insulation break-down factor of safety can be made in the suspended insulator anything desired by varying the number of units in series. Each unit usually has a test voltage of about the full line voltage. On one California 154-mile steel tower line now being operated at 75,000 volts and intended to be operated later at 110,000 volts, five units in series are used, each tested to 65,000 volts giving an ultimate factor of safety of 3. On another 150-mile steel tower line in the same State with the 60,000 volts as present and 100,000 volts as prospective conditions five units tested to 90,000 volts each are used, giving a factor of safety of 3.6.

In case this insulation is found insufficient on a part or on all of the line additional units can be readily added to bring up the insulation to the desired point. The cost of the insulator thus progresses only in direct proportion to the increase in voltage instead of as the cube of the increase in voltage as H. W. Buck states is the case with the "pin and petticoat" type for voltages above 60,000 volts. Under the conditions of a fog storm around San Francisco bay an old style insulator tested to 70,000 volts when clean is often when dirty inadequate to prevent burned off wood crossarms on a 13,000 volt, three phase, 25 cycle line. Here the factor is 5.3, though this is not a factor of "safety" nor even of sufficiency which is yet to be determined.

Another 13,200 volt transmission in the same locality contemplates a three-part insulator of a test voltage of 80,000 or a factor of 6.06. Assuming that city construction averages $50,000 per mile and high tension insulators cost 40 cents each, the cost of high tension insulators is a little over one one-hundredth of one per cent of the total cost of construction exclusive of cars, buildings and power houses on a large street railway system here. Such being the case, the advance from an admittedly inadequate factor of 5.303 to an undemonstratably sufficient one of 6.06 seems over cautious in the light of the great importance of absolute continuity of service in heavy street railway operation demanded now.

The broad almost flat suspension insulator unit is more readily wiped or washed when necessary than the multiple petticoated old style insulator. The flat suspension unit is freer from still air spaces and is less liable to accumulate dust than the numerous closely nested down projecting umbrella shaped parts of the old form. The condition of the suspended insulator is more readily discerned by field glasses from the ground than that of the multiple petticoat supported one. Each one of the five units can be readily reached by the rain if driven slightly by the wind.

The final type of suspended insulator unit has not yet been made, perhaps, but there were two seen in use by the author that seemed very unlikely to be injured by missiles. Both were of the hook and eye type. One was about 3 inches thick and of fish-tail section at the edge and 12 inches in diameter. This one the engineer said could be "dropped from the top of the tower" without breaking—75 feet. The other was ½-inch thick and of rounded section at the edge with but ⅜-inch of dish in 12 inches of diameter. While this latter probably could not be "dropped from the top of the tower" with safety, it could not be broken except by a rifle fired from a point almost directly below. Most of the old style supported type of insulators can be readily broken by stones thrown by hand.

With ten feet of vertical inter-conductor spacing

[1]Contribution to the Committee on Power Distribution of the American Street and Interurban Railway Engineering Association.

and seventeen feet of horizontal spacing there is little likelihood of short circuits occurring from large birds flying through the conductors, from flying twigs or tree limbs, from wind swaying or from small boys' piece of thrown baling wire. Such generous spacing between conductors is not permissible with any present single wood pole construction.

If wood construction were to be attempted on a scale corresponding to that of the steel tower the cost would probably exceed that of the steel tower and would last only eight or ten years whereas the galvanized iron tower should last forever.

H. W. Buck in page 1268 Proceedings A. I. E. E., 1907, states: "In long span installation where the conductor at each end of the span is tied fast to an insulator mounted on a pin, experience has shown that crystallization is apt to take place in the conductor at the tie, due to its rigidity at that point and the vibrations in the span. This frequently results in breakage of the conductor. The flexible connection between conductor and crossarm afforded by the series of suspended insulators should reduce this tendency to crystallization and should therefore permit spans of any length to be used without further precautions against this action."

Mr. Buck continues: "Fears may be expressed that with the conductor suspended under the crossarm serious swinging to and fro might take place. From numerous observations it is believed that no such swinging will occur. Long aerial spans under wind pressure take a permanent and steady deflection throughout the span proportional to the average wind velocity along the span and no indications have been observed of long spans responding to so-called gusts."

This has been the experience in California where after a year's operation on spans varying from 350 to 400 feet and towers varying from 50 to 300 feet high both the steel tower equipped 60,000 volt companies interviewed report no short circuits from high winds.

Of course, there is a lot of bridge engineering that enters into the calculation of dimensions of tower construction that is outside the scope of this paper. Several different kinds of towers are inevitable on a long line—standard towers for straight line work, special towers for transpositions, heavy towers for turns and ends, tall towers for long water crossings, short towers for ridges depending on the topography of the route. The length of most economical towers and span is also a problem in itself, some light on which can be gathered from the article by D. R. Scholes on page 1221 of Proceedings of A. I. E. E. of 1907, entitled "Transmission Line Towers and Economical Spans."

As steel towers consist of many separate pieces which are only assembled when at the point of erection, it is easier to transport a tower piece-meal to a location difficult of access than it would be to transport a wooden pole of equal height. The following questions and answers furnish a brief article in themselves. The former are some of those propounded by the author and the latter emanated from the two 150 mile 60,000 volt steel towered companies previously referred to as operating in California.

	A	B
Ordinary height of tower	50 feet	76 feet
Maximum height for any reason	90 feet	295 feet
Ordinary distance between towers	800 feet	400 feet
Maximum distance between towers	1400 feet	4000 feet
Standard height of lowest conductor	27½ feet	30 feet
Distance apart of conductors vertically	9 feet	10 feet
Distance apart of conductors horizontally	16 feet	17 feet
Breaking strength of each insulator unit.	5000 pounds	9000 pounds
Location of fracture—metal, cement or porcelain	Porcelain	Cement
Number of three-wire circuits on tower	One	Two
Present working voltage	60,000	75,000
Contemplated working voltage	100,000	110,000
Material of conductor	Hard drawn copper	Hard drawn copper
Solid or stranded	Seven stranded	Seven stranded
Splice	McIntyre connectors	Woven.
Soldered or not	No.	No.
Is a continuous cable used between tower tops for pole to pole anchoring purposes or for lightning protection, or both	None used	Both.
Size of cable	None used	Siemen Martin steel.
In case of towers that have fallen, can these accidents, whether caused by bad judgment of workmen, failure of foundation, failure of tower structure, breaks in conductors or flood strains, be obviated in future	Absolutely yes.	Absolutely yes.
What have been the causes of any interruptions to service from troubles on the line proper.	Poor consignment of tie wires used in strain insulators	None.
Do you install over foreign wires guard nets or guard structures of any kind	Yes one insulated cable from pole to pole of foreign line.	No.
Do you maintain a private telephone line on your tower line	No.	No.
Do you contemplate installing one	No.	Yes.
Frequency of patrol.	Every three days	Daily.
Frequency of transposition of high tension line	1/3 of a revolution every 10 miles	1/3 of a revolution every 10 miles
Frequency of transposition of telephone line	Every mile.	Every tower.
Size of conductor	2/0 B. & S.	3/0 B. & S.
Are the results to date of the tower construction and operation satisfactory to you	Yes.	Yes.

There are several firms already engaged in the business of building steel towers for this high tension transmission work. An extremely interesting article describing an up to date steel tower high tension line appears on page 214 of the General Electric Review for May, 1909, by John Liston and entitled "The

Schaghticoke-Schenectady Transmission Line of the Schenectady Power Company." This last mentioned line and the 150 mile 110,000 volt line of the 410,000 h. p. Great Western Power Company of California are practically of the same design– that of H. W. Buck, formerly electrical engineer of the Niagara Falls Power Company and now in San Francisco—except that in the California work several types of suspension insulators are used whereas in the Schenectady work only the General Electric Company's disk type was used.

There is much of interest in the papers and discussions of the Transactions of the 1904 St. Louis International Electrical Congress, Section D, Electric Power Transmission, Volume 11, pages 197 to 424, although like the date it is now five years old.

In all considerations of steel tower construction it must be borne in mind that with a structure having a base 17 feet wide there can be little possibility of using it on a steam railroad right of way, less likelihood of its being permitted on a country road and still less on a city street. One can avail himself of the advantage of steel tower construction only when possessing a private right of way or when passing over wild or sparsely settled country.

To sum up: The steel tower and suspended insulator construction is superior to the wooden poles and supported insulator construction where permissable, aside from the broad fact that wooden poles, of sufficient size to fulfill all the conditions that the steel tower can, are not procurable at all, as follows:

1. Can be installed more readily in locations difficult of access, as can be transported piecemeal.
2. Is cheaper, as fewer used per mile.
3. Is stronger, as made of iron.
4. Has longer life, as galvanized.
5. Is more resistant to missiles on account of shape of insulator.
6. Is more resistant to adjacent fires, as made of iron.
7. Is more resistant to lightning, as insulator is below iron cross-arm.
8. Is more resistant to accidental or malicious short circuits, as has 10 feet of inter-conductor spacing.
9. Is more resistant to short circuits from high winds.
10. Is more resistant to short circuits from climbing wild animals, as affords no hold for claws.
11. Its insulation may be readily and cheaply varied by adding or subtracting units.
12. Is more accessible for detailed observation and cleaning, as more open.
13. Provides greater durability for conductors, as avoids rigid fastening at rigid support.
14. Provides more substantial aerial base for installation of specialties, such as complicated air break switches, lightning arrestors, etc.
15. Being taller, provides better facilities for field glass reconnoissance when hunting trouble.
16. Requires no painting, preservative treatment or repairs.

Disadvantages of the steel tower construction are:

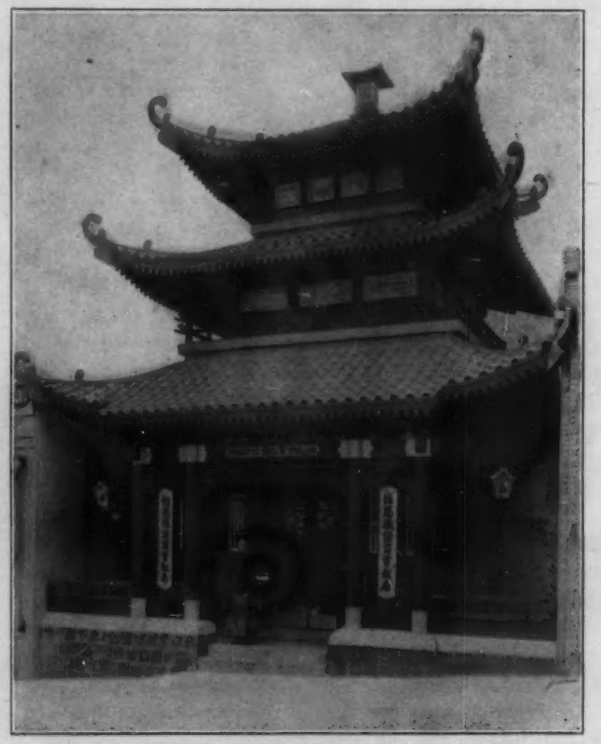
1. Requires a broad right of way on account of wide base of tower.
2. Presents a rare possibility of giving electric shocks to persons touching a tower having defective insulation aloft.

In San Francisco we readily clean and very rarely change insulators on our 13,000 volt lines while in service and I knew of a lineman who changed an insulator on a live 40,000 volt line suspending himself in a "bosun's chair" from a nearby insulator not in use. Ordinarily, however, this working on live high tension lines is a custom, as Hamlet would say, that is "honored more in the breach than in the observance" out here.

SAN FRANCISCO'S NEW CHINESE TELEPHONE EXCHANGE.

The Pacific Telephone and Telegraph Company has completed and is now operating its new Chinese branch office located on Washington street east of Grant avenue, San Francisco. A feature in the design of the building is its strict adherence to the Oriental style of architecture, which is shown in every detail of facade, interior and specially constructed switchboard. The roof is built with three pagodas or overhangs following the design of palaces seen in China where the number of roofs is an indication of importance, it being considered a sign of dignity to possess several roofs, one over the other which serve to protect the interior from the extremes of heat and cold.

In the interior materials similar to those used in China were employed. The woodwork is in rough cut material finished in ebony, the walls being paneled with



San Francisco's New Chinese Telephone Exchange.

glazed tile. The decorations are brought out in highly colored fresco harmonizing perfectly with the dark woodwork of booths and switchboard. Public offices and operators' quarters are provided. The telephone equipment is of the latest type and the switchboard is designed to take care of 3500 telephone stations.

The office is under the management of Mr. Loo Kum Shu, an American-born Chinese, whose efficiency and fidelity to telephone interests are demonstrated by his constant association with this company for the last ten years. He is assisted by one Chief Operator and a corps of Chinese young ladies who handle the business of nearly 800 subscribers.

The Chinese of the Pacific Coast are well recognized factors in the subscription lists of the larger exchanges. Their contracts generally call for the best class of individual service and they are heavy users of toll lines.

THE COMPARISON OF TUNGSTEN AND GASOLINE LIGHTING[1].

In comparing the relative merits and demerits of gasoline and tungsten lighting, cost, quality of illumination and hazard are the most important features to be considered, and besides these three, there are a number of minor considerations, all of which should influence any intelligent consumer in his choice between the two illuminants.

No cost data, which can be given, would be of universal application, because the prices of gasoline and electric power (the latter especially) vary widely. In figuring the monthly cost of the two systems for a certain definite assumed case, however, it will readily be seen how such computations might be altered to fit other rates for power and fuel. The case considered is a large room of ordinary finish and height, equipped with:

1. Bowl-frosted tungsten units, rated with 100-watts and 80 horizontal candle power, and bowl reflectors.

2. Gasoline lamps with chimney and mantle, burning, at a gravity pressure of about 12-in. of water (0.43 lb. per square inch) 2.2 gal. of oil per mantle per 100 hours.

Dimension of room	40' x 40	
Area to be lighted	1600 sq. ft.	
Sq. ft. allowed per rated cp	3	
Rated cp. required	533	
No. of 80 cp. (100 w.) units required	7	
Hrs. burning per month	120	120
Horizontal cp. of unit	80	30
No. of units	7	25
Assumed cost of supply	10c kwh.	10c gal.
Cost of supply per month	$8.40	$10.69
Monthly cost lamp renewals (800 hour basis)	$1.95	
No. cost chimneys and mantles (renewed once in 270 hours)		$1.40
Total monthly expense for illumination	$10.35	$12.09

A gasoline lamp, as above described, will average not over 30 horizontal candle power per month of 120 hours, consuming 2.7 gallons per mantle per month. The light distribution is mainly horizontal, owing to the absence of an efficient reflecting device. Mantle lamps, especially the upright type, are not well adapted to efficient reflectors, owing to:

Variation in the exact location of mantle, making it difficult to keep a fixed relative position of the source of light and reflector;

Deterioration and darkening of mantles and chimneys;

The presence, in some types, of metal parts directly under the lamp, cutting off light;

The small demand for experimentation and development by reflector manufacturers along these lines.

It is a safe estimate that not more than 75 per cent as much useful light per rated candle power is given by the upright mantle gasoline lamp, as is given by the tungsten, "Useful light" meaning light upon the working plane, which is commonly taken at 30 inches above the floor.

Hence, 3.6 times as many gasoline lamps are needed to give the same useful illumination as that obtained with tungsten lamps. The figures indicate for this particular case a monthly saving of about 14 per cent by the use of tungsten lamps.

[1]Selling Electricity.

Tungsten lamps are adapted to, and are regularly provided with efficient scientifically-designed reflectors, whereas gasoline lamps are not. The efficiency of the tungsten filament (1.25 watts per candle) is enormous compared to that of other commercial filaments. Add to this the advantages to be gained from proper reflectors, and it will be seen that the tungsten lamp uses the energy supplied to it far more efficiently, wastes less in heat and useless light, than does any commercial fuel-light in existence.

These lamps are supplied in 25-40-60-100-150-250-watt sizes, making it an easy matter to install them in large or small units as the case requires. In this respect they are more flexible than gasoline lamps. Tungsten light is white light. Mantle lamps have a more or less pronounced greenish hue, by which it is impossible to judge shades of color. Compactness, simplicity, steadiness of light and warmth of color, all tend to give a room illuminated by tungsten lamps a more cheerful effect than one lighted by gasoline.

No portable or table lamps are permitted with gasoline. Such lamps can always be used on an electric circuit, although tungsten filament lamps should preferably not be used for portables. The filament in tungsten lamps is fragile, and servants usually do not appreciate this fact when handling table lamps.

The process of filling, in installations where the gasoline is contained in the lamp itself, is attended with danger and loss of time. Fifteen minutes per day = 91¼ hours per year. Considerable inconvenience is occasioned in lighting gasoline lamps. Tungsten lamps light instantly when the switch is closed.

Tungsten lamps, due to their efficiency, give little heat per candle power, rendering them especially useful in southern localities. They have no odor, nor do they tend to get into poor, inefficient condition, as do gasoline burners and gasoline plants. The expense of overhauling the latter at frequent intervals is an appreciable item.

The depreciation of tungsten lamps with age is nothing when compared with mantle burners. A tungsten lamp will, in the majority of cases, remain at above 90 per cent of initial candle power throughout its entire life.

Variations in quality of gasoline fuel cause large variations in candlepower and may cause flickering. With ordinary voltage regulation, this effect is not observable with tungsten lamps.

Hazards may be divided into two classes; those common to all gaseous illuminants and those peculiarly likely to occur with gasoline. In the first class may be included accidental causes, such as started the following fires:

Curtain string blew into the flame.

Sweeper moved a bed containing draperies against a lighted lamp.

Man lighting gas ignited curtains.

These causes, common to both gas and gasoline systems, require no further comment.

Explosions, for reasons to be outlined presently, are peculiarly apt to occur with gasoline. The immediate cause may be any one of a thousand unexpected events. One case is on record where a small boy lighted a match and threw it at a man working over

a tank containing volatile oil, with results to be anticipated. Static electricity, the driving of a nail, or anything, which produces a spark, is sufficient to fire an explosive mixture.

Gasoline is one of the most volatile of the ordinary products of crude petroleum, from which it is obtained by "fractional distillation." It contains all the elements of petroleum, which vaporizes at a temperature below 72 degrees Centigrade. When gasoline is mixed with air, it forms an explosive combination, and under ordinary atmospheric conditions it is constantly giving off its lighter vapors. The relative quantity of gasoline vapor and air present, determine whether the mixture is explosive or merely inflammable. The vapor from one pint of gasoline mixed with air will make 200 cu. ft. of explosive.

The following table shows the volatility of gasoline as compared with common liquids. It should be understood that the properties of gasoline depend somewhat on its specific gravity, which varies with different grades.

	Vapor Pressure at 68° F.	Loss per Hr. in c.c. at 68° F. from a beaker 77 mm. diam.
Kerosene	0.3	0.13
Turpentine	0.4	0.17
Distilled water	1.74	0.29
95% commercial alcohol	4.5	0.88
Completely denatured alcohol	5.5	0.98
Gasoline 66°	6.6	1.32
Wood alcohol	8.8	1.56

It sounds at first somewhat like a paradox to speak of rigidly classifying liquids according to the risk of danger connected with their use. With records of thousands of past fires, however, and a knowledge of the chemical and other properties of dangerous liquids, upon which to base calculations, this can be done, and has been done by Mr. A. H. Nuckolls, Chemical Engineer, Underwriters' Laboratories. Mr. Nuckolls' method is as follows:

He starts by tabulating the 12 principal characteristics which are possessed in a greater or less degree by all hazardous oils:

Range of vapor-air explosive mixtures, ignition point, flash point, combustibility (burning point), vapor density, volatility, chemical activity or hazards in combinations, ability as a factor in spontaneous ignition, ability towards leakage, ability as a corrosive agent, resistance when burning to the extinguishing action of water, violence of vapor-air explosive.

Having made this list, and taken ether as a standard, or 100 per cent of hazard, he prepares curves showing approximately how the various properties named affect the hazard, and that there is a sharp rise in hazard whenever these properties occur at or near average room conditions of temperature and pressure. The method is laborious, some 21 curves being exhibited, but the following extract from the final results should be of interest as showing the "high-standing" of gasoline in a scientifically prepared rating of hazardous fluids:

Substance	Total Hazard
Ether	100.%
Carbon bisulphide	105.5
Benzine (C_6H_6)	90.7
Gasoline	99.4
Benzine (petroleum product)	90.
Alcohol (wood)	73.7
Alcohol (denatured)	73.2
Alcohol (grain)	65.
Kerosene	36.5
Turpentine	36.7
Linseed oil	32.5
Paraffine oil	7.3

More chances are commonly taken with gasoline than with gunpowder, and it is recognized that the precautions advised are violated in countless cases; but from the standpoint of properly safeguarding a building against fires they ought to be observed.

Gasoline should be stored in good heavy underground tanks placed as far as practicable from the building. Mr. Alfred G. Patton, in an article in the National Fire Protection Association Bulletin, Oct. 1, 1907, recommends the following practice for storage.

"Tanks should be of 3/16-in. boiler iron tested to 100 lbs. per sq. in., and coated on the outside with tar; all the connections for filling and pumping to be made in top of tank; tanks to be encased in a concrete covering on all sides and over top at least 12-in. thick, to prevent, as far as possible, leakage and consequent filtering of the oil through the ground into cellars. Where it is necessary to place tank underground in close proximity to a building under which there is a cellar, top of tank should be sunk below the level of such cellar to eliminate the danger of drainage from a possible leak. Storage tanks for volatile oil should be filled from outside the building."

Especially in factories equipped with a gasoline systems, it is advisable to have all gasoline drain from the building, and shut off all gasoline cocks at entrance to buildings at night. Tanks should be so set that the top of the tank is below the bottom of generators and also below the grade of the plant supplied. It should be noted, however, that the higher the pressure of feeding at any particular lamp, the more dangerous that lamp becomes.

Mr. Victor L. Scott, of the San Antonio Gas & Electric Company, has prepared a legal digest on gasoline lighting permits which has been published in the American Gas Institute proceedings. Court decisions are cited to show that:

1. Any of the numerous restrictions contained in gasoline lighting insurance permits, when violated by the insured, voids the policy.

2. The violation of any of these restrictions by the occupant of a building not only voids his policies on stock, but also voids the policies of the owner of the building ,regardless of the fact that the owners' policies have attached thereto gasoline lighting permits.

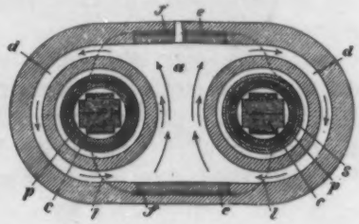
3. On a strict interpretation of the law it is almost impossible to handle this deadly explosive in such a manner as not to violate restrictions contained in any gasoline lighting permit.

4. Mr. Scott cites numerous cases which bear out these conclusions.

Therefore, even granting that the expense of electric lights may be 10 per cent greater than the gasoline as a lighting proposition, the fact that the so-called gasoline lighting permits practically cancel the insurance policies of the occupant of the building, as well as the policies of the owners of said buildings, is sufficient argument when fully established to put all gasoline lighting plants on the trash pile. There are numerous cases on record where the insurance company has been relieved of liability on just such grounds.

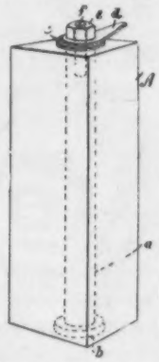
PATENTS

939,095. Electric Furnace. Hermann Rochling and Wilhelm Rodenhauser, Volklingen, Germany, assignors to The Grondal Kjellin Company Limited, London, England. In an electric transformer furnace, in combination a magnet core (c) piercing the furnace and having a primary and a secondary winding (p and s), the smelting room in the furnace being



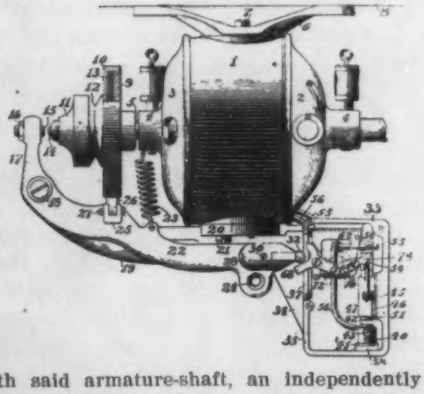
formed by an annular channel (d) surrounding the magnet core, a portion of the channel (a) being widened to form a smelting hearth and terminal plates (e, f) arranged within the sides of said smelting hearth, adapted to electrically connect the secondary winding with the material within said smelting hearth.

938,471. Grounding Device or Terminal for Line-Wires. William R. Garton, Brooklyn, N. Y. The combination in a grounding device or terminal of a mass of hygroscopic and



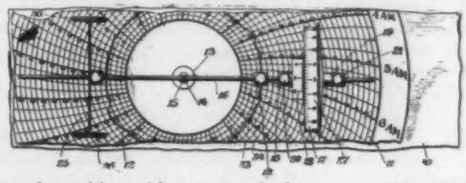
of non-hygroscopic material, and granulated coke or charcoal, constituting a hard and cellular substance, with a metal rod extending into and secured in the mass, provided with means of attachment to a line wire.

938,649. Controller for Electric Motors. Frederick Diehl, Elizabeth, N. J., assignor to Diehl Manufacturing Company. A driving device comprising an electric motor including a rotary armature-shaft, a driving clutch-member connected to



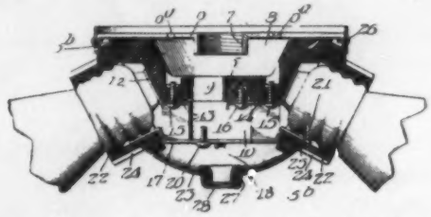
rotate with said armature-shaft, an independently mounted driven clutch-member having means of connection with the machine to be driven, a reciprocatory operating member for effecting the establishment and interruption of driving relation between said clutch members, an electric switch connected with said motor and provided with an actuating lever extended into the path of movement of the clutch-operating member, and a spring to complete the throw of the switch lever initiated by its engagement with the clutch-operating member.

938,662. Radius-Averaging Instrument. William H. Bristol, Waterbury, Conn., assignor to The Bristol Company, Waterbury, Conn. In a radii averaging instrument; the combination with a suitable base; of a guiding device free to rotate thereon and providing a vertical guideway; a tracer-bar pass-



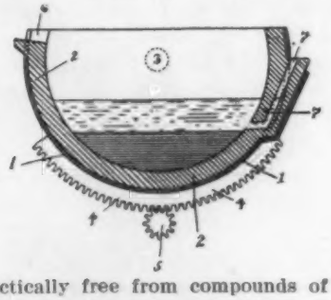
ing through said guideway and free to slide lengthwise therein; a forked support for said tracer-bar, terminating in finger pieces; an intergrating wheel rotable on said tracer-bar; and a tracing point carried by said tracer-bar and projecting downwardly therefrom.

938,632. Cluster-Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. In a plural lamp-holding device, a casing having a plurality of openings, an insulating block within said casing, and an insulating threaded lamp-holder



in each of said openings, each of said lamp-holders comprising a ring having two diameters and having its smaller part passed outward through one of the openings of the casing, the larger portion of the ring being confined between said casing and said insulating block and thereby held against inward movement.

938,634. Metallurgical Process. Anson G. Betts, Troy, N. Y. The process of making aluminum which consists in reducing aluminum oxide in presence of other suitable less reactive metal, producing thereby an alloy of aluminum with a less-reactive metal, reacting on the alloy with a suitable material capable of producing therewith an aluminum



compound practically free from compounds of more readily-reducible metals than aluminum and reducing aluminum from said aluminum compounds.

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FOUNDED 1887 AS THE
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Life Hazard of Electricity

Statisticians tell us that in the United States there is a death a day from electric shock. While this is only a small proportion of our total population and is but a fraction of the number of deaths due to other causes, yet its increase is alarming. We find in the mines that the number of accidental deaths bears a nearly constant ratio to the number of men employed, and that likewise in the electrical industry the toll exacted by death has kept close pace with its phenomenal growth.

These casualties are regretable because they are easily preventable. Nine-tenths of them result from ignorance or carelessness. The ignorance can be corrected by widespread publicity as to the dangers of electricity. Not that electricity is any more dangerous than other means of producing light and power, but this danger is not recognized. It took years for the housewife to learn the hazard of the gasoline stove. Asphyxiation by illuminating gas seems to be a favorite method of ending the known troubles of this life for the unknown of the next. Yet by the exercise of reasonable care these agents, like electricity, can be safely used.

There are a few ordinary precautions that every one should remember. Do not touch a bare wire with the bare hand. Do not turn on an electric light while standing in the bath tub, nor turn up the gas while holding the telephone. In either case your body may become the connecting link to the ground. The cynic's advice, to think every man dishonest until he proves himself otherwise, can be aptly applied in considering every wire dangerous until it is proved otherwise. Carelessness is due to the familiarity bred by contempt. It is usually the expert swimmer that is drowned. In electrical work one man's carelessness may endanger not only his own life, but also those of many fellow workers.

These subjects are ably discussed in this issue in the article on "The Life Hazard and Resuscitation in Electrical Engineering," by Mr. Clem A. Copeland. The paper further includes a proposed set of city ordinances whose enforcement would minimize danger from this source, and also gives many valuable suggestions to wiremen. The most interesting part of the paper is found in the concluding directions for resuscitating a person who has received an overdose of electricity. The author makes a significant statement, "It seems probable that all deaths could be prevented by prompt and long continued methods where the shock has not effected a vital wound or an actual disintegration or change of vital tissue." The methods outlined are in many respects similar to those for reviving a drowned person, and are based upon the fact that an electric shock is a case of suspended animation due to lack of circulation. Emphasis is laid upon the necessity of prompt and long continued treatment. Wide dissemination of this information should lessen the death rate from electrical causes. Meanwhile it is well to remember that an ounce of insulation is worth a pound of cure.

CURRENT COMMENT

Telephones on trains standing in stations are to be installed by the Southern Pacific Company in every city on the Pacific Coast. The telephones will be connected thirty minutes before each train leaves the depot and be disconnected one minute before starting time.

Electric curing of ham was discussed at a recent meeting of the American Meat Packers' Association. This process is said to be not only cheaper but also to impart better keeping properties to the meat. The meat is placed in a vat filled with a pickle of sugar, salt and saltpeter, through which an electric current is passed.

The energy of ocean waves, per meter of coast line, has been found by Professor Ricardo Salvadori of Italy to be but little over one horsepower per annum and to recover this one horsepower would require about $1000. This high cost, coupled with probable storm damage, shows the impracticability of this scheme for the coast of Italy.

The use of telephone wire for repairing harness, when none other is to be had, is the cause of an occasional service interruption in some parts of Washington. According to the Brewster Herald, the telephone service between Brewster and the Brewster Lumber Company's mill is not in a present state of perfection, owing to the fact that those who happen to need a piece of wire find it convenient to appropriate a portion of the telephone system to supply the above-named need. It is the desire of those who have the line in charge to impress the fact that those caught tampering with the line will be prosecuted.

United States water powers are listed in a pamphlet from the United States Geological Survey, which deals with the conservation of water resources and the water-powers of the country. It is stated that out of 37,000,000 horsepower available in water-power at the minimum flow of streams, but little more than 5,000,000 horsepower has been developed, or about one seventh of the minimum available power. The State of New York has the largest development with 885,862 horsepower. California standing next with 466,774 horsepower. The publication presents statistical tables of water-powers covering all sections and States.

Forestry in California is summarized in a folder from the California State Board of Forestry from which we extract the following: California has 100,000,000,000 feet of standing timber, even now worth $400,000,000 as a resource. If manufactured and sold even at present lumber prices, it would bring $2,500,000,000 into the State for labor and supplies. California sells over $20,000,000 worth of lumber a year. Of this, $14,000,000 is received by employees, who put it into local circulation. About 1,000,000,000 feet is destroyed by fire in California every year. If manufactured, it would bring in $15,000,000. On every 1000 feet burned the stumpage owner loses at least $3, but the community loses $8 in wages. Timber means pay checks to support all industries, but burned timber pays no wages. Care with small fires is the best way to prevent big ones. Don't toss away burning matches or tobacco! Don't make a camp-fire in leaves, rotten wood or against logs, where it may spread or you can't be sure it is out. Always clear away all inflammable material before building your camp-fire! Never leave a fire until it is out! Don't burn brush, grass or slashings without a permit from a fire warden. "Don't operate an engine using fuel other than oil without having it equipped with a spark arrester. Put out any fire you find if you can. If you can't notify a fire warden or other public officer or the landowner. Remember that any little fire may become a big one if left alone."

The light of the fire-fly has an efficiency of 96.5 per cent according to investigations conducted by Dr. H. E. Ives and W. W. Coblentz as reported in the Transactions of the Illuminating Engineering Society. The efficiency of the light of the carbon filament lamp is .43 per cent; in other words, of all the energy consumed only .43 per cent is converted into light. The tungsten lamp has an efficiency of 1.3 per cent, and the mercury arc 3.8 per cent. Making the comparison in another form: the carbon filament lamp has an efficiency of 83 watts per mean hemispherical candle; the tungsten lamp 1.6 per candle, and the metallic arc .55 watts per candle. In comparison with these the firefly has an efficiency of .02 watts per candle.

Grounding of secondaries was indorsed by the International Association of Municipal Electricians at their recent convention in Atlantic City. In view of the "destruction of life and property that has resulted from high voltages on alternating current secondary systems by reason of the failure of the insulation between the primary and secondary circuits of such systems, and whereas, the existence of the said high voltages may be prevented by properly grounding the alternating current secondary systems; it was resolved that this body, urge and demand the enactment of proper legislation requiring the grounding of all alternating current secondary systems, when by so doing, the voltage between the earth and any part of the said secondary system will not exceed 250 volts."

The manufacturer's census schedule, which is to be circulated early in 1910 by the Bureau of the Census, contains thirteen principal questions, with their subdivisions. One of the subdivisions of the question relating to power employed for manufacturing purposes calls for the name of the stream or lake from which water is obtained to generate power, whether direct or electric. This information will furnish a first step toward a census of the country's water-power plants and operations should Congress specifically authorize such a census in the future. Another new question involves the quantity of fuel used, whether anthracite coal, bituminous coal, coke, wood, oil, gas, or other kind. This is expected to elicit replies affording considerable data on the fuel-conservation question.

JOURNAL PORTRAITS

Leon St. D. Roylance was born in Geneva, Illinois, April 21, 1873, but received his schooling in the public schools of California. In 1888 he entered the employ of The J. Roylance Brass Works in San Francisco, learned the trade of brass-finishing or brass machinist and electro-plater; he then took a commercial course in the Pacific Business College, graduating in 1890, then continued in the employ of the Roylance Brass manufactory as accountant and manager of sales department. During this employment, he made a special study of mathematics and the design and construction of dynamos and motors and electrical engineering in general; he continued the studies and private experiments until the year of 1893, when he resigned his position with the brass works to enter the electrical field, taking up the design and construction of dynamos,

Leon St. D. Roylance

motors and electrical appliances as a specialty. He continued such work until the year 1895, when he entered the employ of the New Era Gold Mining and Milling Company, of Nevada, as constructing engineer, resigning this position in 1897 to accept the position as managing engineer of the Acme Electric Manufacturing Company, which position he resigned in 1898, to conduct an office as consulting and constructing electrical engineer, which he conducted until 1903, when he entered the employ of the United States Government as electrical engineer in the office of the Bureau of Equipment, Navy Department, U. S. Navy.

He was stationed at the Union Iron Works, this city, during the construction of the following naval vessels: U. S. submarine boats "Grampus" and "Pike"; U. S. S. "Tacoma," "Ohio," "Milwaukee," "California" and "South Dakota." Much of the electrical apparatus installed on board the vessels was built and installed by the Union Iron Works, and Mr. Roylance was in charge of the inspection and testing of most of the electrical apparatus during the preliminary shop tests and the final acceptance tests on board. As the tests required by the Bureau of Equipment, Navy Department, are very rigid and exacting, Mr. Roylance has had the opportunity of conducting many varied and intricate tests that are not met with in the ordinary commercial practice.

Mr. Roylance, having resigned his position with the Government has again opened an office as consulting and constructing electrical and mechanical engineer at 82 Second street, San Francisco.

PERSONALS.

G. W. Bacon of Ford, Bacon & Davis of New York, is in San Francisco.

S. Wyman Rolph left San Francisco last week for a fortnight's trip in the Northwest.

Thos. Mirk, president of Hunt, Mirk & Co., of San Francisco, left for the East this week.

Donald H. Fry, hydraulic engineer, of Concord, Cal., was a visitor to San Francisco last week.

Irving W. Philips is expected in San Francisco this month, having resigned his position in Mexico.

Jos. Mayo of the Contra Costa Light & Power Company at Martinez, Cal., was in San Francisco this week.

W. E. Osborn, manager of the Woodland Electric Company of Woodland, Cal., was a recent visitor in San Francisco.

W. S. Hoskins, formerly shop manager for Kilbourne, Clarke & Co., of Seattle, is now sales engineer with the Seattle office of the Allis-Chalmers Company.

L. O. Grondahl, who last year was professor of physics and mathematics at Spokane College, Spokane, Wash., is now instructor in physics at the University of Washington, Seattle, Wash.

W. H. Evans recently resigned as superintendent of the Central California Traction Company, Stockton, Cal., to enter the electrical department of the Southern Pacific Company at Portland, Oregon.

P. G. Jones has established Pacific Coast offices for the American Electric Fuse Company, of Muskegon, Mich., at 121 Second street, San Francisco, with a full line of this company's products.

Edwin B. Pike and Arthur B. Lebenbaum, who recently sold their interest in the Butte Engineering & Electric Company, of San Francisco, are now handling fixtures, lamps, heating appliances, electrical novelties and fixture glassware.

A. F. van Deinse, who recently completed the installation of a power plant for the El Tiro Copper Company, of Silverbell, Arizona, has accepted a position with the Westinghouse Electric & Manufacturing Company in their El Paso, Texas, office.

A. D. Miller, who for the last two years has been assistant engineer with the Reno Power, Light & Water Company and the Truckee River General Electric Company, has resigned to accept the position of manager and superintendent of the Reno Traction Company.

Henry R. Stevens, former superintendent of electric power, Indiana Steel Company, Gary, Ind., has resigned his position and returned to Seattle, Wash., where he will associate himself with A. S. Downey, consulting engineer, whose specialty is hydro-electric and industrial plants.

Perry O. Crawford, who until the date of its completion on August 20th had charge of the design and installation of the Northern California Power Company's new south power house at Manton, Cal., has taken charge of the installation of the Inskip power house for the same company, with headquarters at Paynescreek, Cal.

Edwin Duryea, Jr., of the firm of Duryea, Haehl & Gilman, consulting engineers, returned to San Francisco on November 9th from a professional trip. Mr. Duryea is engineer for South San Joaquin Irrigation District, and filed his completed report to that company at Manteca on October 15th. The report estimates a total maximum cost of $1,861,500 for the project, or $26.59 per acre.

NEWS OF THE STATIONARY ENGINEERS

PREAMBLE.—This Association shall at no time be used for the furtherance of strikes, or for the purpose of interfering in any way between its members and their employers in regard to wages; recognizing the identity of interests between employer and employe, and not countenancing any project or enterprise that will interfere with perfect harmony between them.

Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the business of the Association, and at all times preference shall be given to the education of engineers, and to securing the enactment of engineers' license laws in order to prevent the destruction of life and property in the generation and transmission of steam as a motive power.

California.

No. 1. San Francisco. Thursday, Central Hall, 124 Fulton St. Pres., P. L. Ennor. Sec., Herman Noethig, 816 York St.

No. 2. Los Angeles. Friday, Eagles' Hall, 116½ E. Third St. Pres., J. F. Connell. Fin. Sec., Harry Notthoff, 1307 Winfield St. Cor. Sec., W. T. W. Curl, 4103 Dalton Ave.

No. 3. San Francisco. Wednesday, Merchants' Exchange Bldg. Sec., David Thomas, 914 O'Farrell St.

No. 5. Santa Barbara. Geo. W. Stevens, 2417 Fletcher Ave., R. R. No. 2.

No. 6. San Jose. Wednesday. Pres., W. A. Wilson, Sec., Lea Davis, 350 N. 9th St.

No. 7. Fresno. Pres., A. G. Rose. Sec., E. F. Fitzgerald, Box 651.

No. 8. Stockton. Thursday, Masonic Hall. Sec., S. Bunch, 626 E. Channel St. Pres., H. Eberhard.

Oregon.

No. 1. Portland. Wednesday, J. D. Asher, Portland Hotel. Pres., B. W. Slocum.

No. 2. Salem. A. L. Brown, Box 166.

Washington.

No. 2. Tacoma. Friday, 913½ Tacoma Ave. Pres., Geo. E. Bowman. Sec., Thos. L. Keeley, 3727 Ferdinand St., N., Whitworth Sta.

No. 4. Spokane. Tuesday. Pres., Frank Teed. Sec., J. Thos. Greeley, 0601½ Cincinnati St.

No. 6. Seattle. Saturday, 1420 2d Ave. Pres., H. R. Leigh. Sec., J. C. Miller, 1600 Yesler Way.

Practical letters from engineers and news items of general interest are always welcome. Write your items regardless of style. Communications should be addressed to the Steam Engineering Editor.

PORTLAND NO. 1, N. A. S. E.

This association is growing steadily now, having 122 members, with one or more initiations every meeting night. The educational committee has started a campaign for the winter, consisting of a series of open meetings to which will be especially invited architects, consulting engineers, employers, manufacturers' agents and all others interested, who do not belong, some of whom have a very vague idea of the aims and objects we are striving for. Many otherwise well informed people have a notion that the N. A. S. E. is a part of or an offshoot of the union. Nothing could be farther from the truth. At these open meetings will be presented papers and lectures on different phases of engineering, also discussions of particular questions brought up, showing the lines along which earnest members are working for an education which will bring results in the way of increased salary. Lately the association was favored with a paper on "Heating and Ventilating Office Buildings" by H. E. Raymond; also one on "Induction Motors" by O. B. Coldwell, and a highly instructive lecture and demonstration, with an instrument for detecting, the variation in speed from no load to full load. Title, "Engine Governors and Speed Regulation," by B. C. Ball. Our delegation to the Columbus convention, consisting of our Corresponding Secretary, J. D. Asher, and Conductor McIntosh, arrived home in due time, and have made elaborate reports. It took several meeting nights for them to tell what they saw and how the saw it.

SAN FRANCISCO NO. 1.

At a recent meeting of S. F. No. 1 Mr. Bregard gave an account of some electrical problems and difficulties he experienced at his plant during the past week, which brought forth considerable discussion on the part of other members and on other subjects. Interesting accounts were received from the following visiting members: Bro. Templeton of Pueblo, Colo.; Bro. Dineen of Los Angeles, and also from one of our oldest members who has been in the southern part of the State for the past five years, Bro. John Grenzin. Bro. John Tillman read an extensive and interesting report of the work of the National Convention which was held in Columbus, Ohio. Bro. F. H. Cherry will deliver a lecture in the near future on the subject of Freezing Fish.

NEW CATALOGUES.

John R. Proper & Co., 429 Central Building, Los Angeles, Cal., are distributing an interesting leaflet on the Proper Nebulizing Oil Burner. It contains a table of tests of crude oil from California and Mexican fields.

Bulletin 5B from the engineering department of the National Electric Lamp Association is entitled "Modern Street Railway Lamps." special attention being given the tantalum filament lamp for direct current service.

The Ohio Brass Co.'s Bulletin for October contains two articles on electric coal haulage, notes on suspension insulators for 110,000 volts, an account of the railway convention at Denver and a description of their manufacturing plant.

Catalogue No. 7 from G. E. Witt Co., 850 Howard street, San Francisco, illustrates and describes the application of several styles of Witt oil burners, pump governors and air compressors. It includes much valuable information on fuel oil and boiler efficiency.

"Seventy-five Years of Engine Building" is the title of a beautiful brochure from the C. & G. Cooper Co. of Mount Vernon, Ohio. In it is traced by text and appropriate illustration the history of this company's work in building engines since 1833. Included also is an account of their present facilities and a description of their output. Typographically, it is a model of the printer's art and reflects great credit upon the C. &. G. Cooper Co.

The Electric Storage Battery Company has recently issued two bulletins on the "Chloride Accumulator" in Book I. P. is devoted to the "Chloride Accumulator" in Small Isolated Lighting Plants and is intended primarily to facilitate the choice of type for the desired service. Hand Book L. V. treats of the "Chloride Accumulator" for Low Voltage Isolated Plants with Tungsten Lamps. It includes a convenient table showing the dimensions and corresponding capacity in amperes and equivalent tungsten lamps for the various types of batteries.

TRADE NOTES.

The General Electric Company reports very gratifying sales of tantalum lamps. The sales of this lamp are more than double what they were a year ago and the lamp appears to be sharing in the demand for high efficiency lamps created by the introduction of tungsten lamps. The tantalum lamp, as at present supplied, is giving most excellent life service. Contrary to general belief, these lamps will give good commercial life on alternating current of 60 cycles or less. Their life on this frequency will average well above 600 hours.

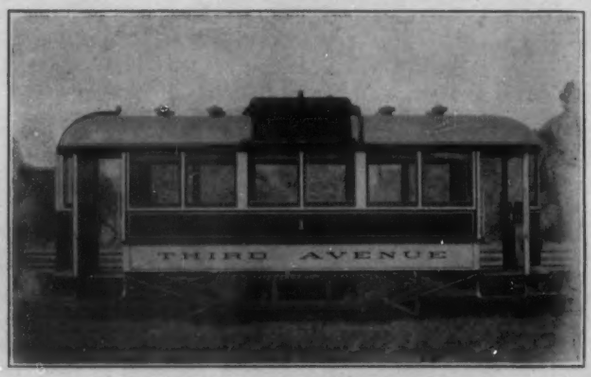
The Pelton Water Wheel Company continues to report the sale of Pelton-Francis turbines for pressures ranging from 45 to 428 ft. A contract has recently been awarded them for two 150 h. p. turbines to operate under 45 ft. head at 900 r. p. m. These will be double cylindrical encased turbines, each controlled by a Pelton oil pressure governor. Owing to the fact that both machines must be sectionalized for mule-back transportation, the design of the machines will have to be special throughout. Contract has also been awarded the Pelton Company for a 1200 h. p. 600 r. p. m. Pelton-Francis turbine to operate under 420 ft. head. This latter equipment will be placed in the power house of the Tuolumne Electric Company, near Groveland, Cal.

INDUSTRIAL

A GAS ELECTRIC MOTOR CAR FOR THE THIRD AVENUE RAILWAY COMPANY, NEW YORK CITY.

The General Electric Company has completed the construction of a single truck car for the Third Avenue Railway Company of New York, which is driven by a totally enclosed gas engine mounted between the axles. As shown in the photograph the car resembles in many respects the short cars on many of our city railroads, and in operation can scarcely be distinguished from an ordinary electric car.

The gas engine has a four cylinder, four stroke cycle engine direct connected to a generator and exciter, and the electrical energy thus developed is transmitted to two railway

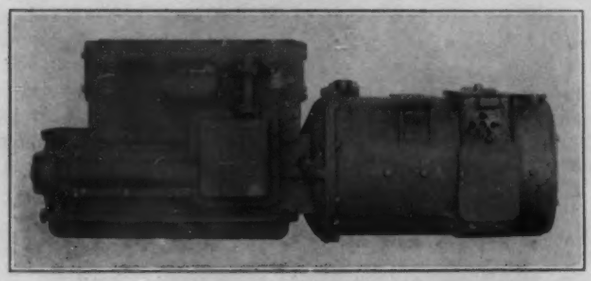


Third Avenue Gasoline Electric Car.

motors mounted on the axles. The car is operated from either end by an electrical controller in the same manner as a trolley car. The controllers on each platform connect the motors progressively in series and in parallel, and regulate the voltage supplied to the generator, as required by the speed of the car. In this way all mechanical connections between the gas engine and the driving axles are eliminated. The gas engine, provided with automatic centrifgual throttle governor, runs at constant speed regardless of the speed of the car, and thus operates at all times at high efficiency. The operator has no auxiliary levers for controlling the gas engine or the car.

The Bosch low tension magneto supplies the ignition system, which is of the "make and break" magnet plug type. The engine is started by a crank direct from the magneto.

The exciter referred to above supplies power for the main generator field and for the lighting of the car.



Type GM-21-A1-35/40-800 Gas Motor Direct Connected to Type TD-615-800-250 Volt Generator.

The car has no monitor, its roof being dome-shaped with suction ventilators. Water cooling radiators are placed on the roof over the center of the car and are connected to the water jackets of the cylinders by pipes enclosed within the center posts of the car. The circulation is semi-siphon.

The truck is of special light construction of riveted plate frame, equipped with Hess-Bright ball-bearing journal boxes. The truck frame is supported on coil springs and is steadied by half elliptic springs at the ends of the truck frame.

The following are some of the general dimensions:

Length over all, 28 ft.; length of body over end frames, 19 ft.; wheel base, 7 ft 6 in.; height rail to top of roof, 12 ft.; width over all, 8 ft.; seating capacity, 26 ft.; weight complete equipped, 12 tons.

NORFOLK & WESTERN RAILROAD ADOPTS TELEPHONE TRAIN DISPATCHING.

The Norfolk & Western Railroad has recently put into service two telephone circuits for handling its trains, one between Roanoke, Virginia, and Bluefield, West Virginia, 102 miles, the other between Bluefield and Williamson, West Virginia, 107 miles. There are sixteen stations on the former circuit and twenty-two stations on the latter. Western Electric Company's telephone equipment and Gill selectors are used on both circuits. This equipment extends through some very mountainous country and affords a good test of telephone train dispatching under very severe conditions. This equipment has been in service since September 25, and Mr. W. C. Walstrum, superintendent of telegraph, reports that both circuits have been giving excellent service since that time. A feature of interest in connection with one of these circuits is that the telephone was pressed into service before being fairly completed owing to the telegraph circuits having gone out of commission due to the recent widespread electrical disturbance attributed to the Aurora Borealis, or northern lights.

THE "CHLORIDE ACCUMULATOR" FOR A. C. REGULATION.

The rapid increase in the use of alternating current for transmitting power for long distances to supply systems having rapidly fluctuating loads has created a field for the application of the storage battery for regulating the fluctuations of load on an alternating current circuit. This demand has led The Electric Storage Battery Company to develop several systems for accomplishing this purpose including new types and designs of transforming and controlling apparatus, especially adapted for this class of service. Among these devices may be mentioned the split pole rotary converter designed and developed by the company to eliminate the use of a booster and by dispensing with two revolving armatures (for the booster and its motor) materially simplifying the installation. Another device is the specially designed a. c. solenoid for operating The Electric Storage Battery Company's standard carbon regulator in response to the energy component of the alternating current. A new type of a. c. and d. c. exciter has also been developed by this company, designed to deliver direct current to the fields of a booster or converter responsive to small variations of alternating current.

No less than eight installations of the "Chloride Accumulator" have already been equipped with controlling apparatus for regulating fluctuations of a. c. load. These installations cover a wide variety of applications including several direct current trolley systems supplied by alternating current through rotary sub-stations; one single phase electric railway; and two installations for controlling the fluctuations in steel mills where the generating machinery includes both a. c. and d. c. units and the load is partly a. c. and partly d. c. The battery installed for the United Steel Company at Gary, Ind., which is the largest plant of this character in the world is provided with the split pole converter and a. c. and d. c. exciter mentioned above.

NEWS NOTES

FINANCIAL.

HOLTVILLE, CAL.—The City Clerk will receive sealed bids up to November 22d for purchasing bonds in the sum of $37,000 with which to construct a waterworks system in this city.

CENTRAL POINT, ORE.—Recorder T. M. Jones has received notice from S. A. Kean & Co., the Chicago bond buyers, that the final papers relating to the deal from the town to that firm has been received and found satisfactory.

LOS ANGELES, CAL.—Resolutions have been adopted by the Council declaring that it was necessary to issue harbor bonds amounting to $3,000,000 and aqueduct power bonds amounting to $3,500,000 for improvements for the municipality.

HOOD RIVER, ORE.—The City Council has passed an ordinance calling for a bond election to be held November 12 to decide whether or not the city shall float bonds to the extent of about $90,000 for the installation of the municipal system.

SAN FRANCISCO, CAL.—The Board of Supervisors has ordered that the clerk advertise the sale on December 6, 1909, the following municipal bonds, issue of July 1, 1908, the same to be sold under the terms and conditions that shall be prescribed by the committees on Public Uutilities and Finance of the Board of Supervisors. Fire protection bonds to the amount of $1,200,000, comprising thirty bonds of each year's maturity from 1916 to 1955 inclusive. Sewer bonds to the amount of $1,000,000, comprising twenty-five bonds of each year's maturity from 1915 to 1954 inclusive. School bonds to the amount of $800,000, comprising thirty-two bonds of each year's maturity from 1914 to 1938 inclusive. Hospital bonds to the amount of $440,000, comprising twenty-two bonds of each year's maturity from 1913 to 1932 inclusive. Garbage system bonds to the amount of $200,000, comprising ten bonds of each year's maturity from 1911 to 1913 inclusive.

INCORPORATIONS.

PORTLAND, ORE.—Home Electric Appliance Company of Portland, $10,000, by H. H. Taylor, W. B. Ensworth and G. F. Brice.

SAN FRANCISCO, CAL.—The Malden Water Works Company, of Malden, $50,000, by A. J. W. Schofield, S. A. Duggins, J. A. Sourbaugh.

LOS ANGELES, CAL.—Electric Device Company, capital stock $25,000, subscribed $300, by F. A. Garbutt, E. J. Ovington and S. C. Hall.

RIVERSIDE, CAL.—Jorupa Water Company, capital stock $50,000, by Arthur Wright, Geo. H. Emms, F. H. Brook and others of Los Angeles; place of business, Riverside.

PETALUMA, CAL.—Petaluma Rural Telephone Company, capital stock $50,000, subscribed $1000, by D. M. Winans, T. G. King, G. B. Robinson, S. L. Stice, E. P. Long, Frank Whitlatch.

EUGENE, ORE.—Articles of incorporation have been filed for Eugene Heating & Electric Power Company, capital stock $15,000, by S. H. Friendly. The object of the company will be the construction of a central heating plant.

SAN FRANCISCO, CAL.—Pacific Electric Motor Company, capital stock $20,000, shares $1 each, subscribed $5, by W. A. L. Miller, O. W. Nordwell, J. W. Carmany, H. G. Meyer and A. P. Dessouslavy, 1 share each; place of business, San Francisco.

TRANSMISSION.

SACRAMENTO, CAL.—The first business in which the Western Power Company will engage hereabouts will be the supplying the dredgers near Folsom..

CHEHALIS, WASH.—Manager Welch of the Twin City Light and Traction Company, announces that a new power plant will be built on Coal Creek next spring.

SPOKANE, WASH.—The Northern Idaho and Montana Power Company has acquired the plant of the Big Fork Water Company at Kalispell, Mont., and will enlarge and improve it.

FRESNO, CAL.—The San Joaquin Light & Power Company will supply the foothill country near here with water for irrigation by means of a pumping plant to be run by electric power.

BUCKLEY, WASH.—The Buckley Electric Company is making a number of changes in its plant, in addition to purchasing a new 125 horsepower boiler. The capacity of the plant will be doubled.

MARTINEZ, CAL.—Sealed bids will be received until December 6th, 1909, for a franchise to be granted for a period of 50 years for placing wires, poles, etc., along the roads of the county of Contra Costa.

GRANGEVILLE, IDA.—B. Gastein and William Stinson of Spokane have leased the plant of the Grangeville Electric Light & Power Company on the Clearwater River, seven miles from here, and will improve and extend same.

KENNEWICK, WASH.—Work has been started on the power house of the Yakima Valley Power Company, which will be 69x75 feet, with 22 foot wall around the boiler rooms. It is probable that $12,000 will be needed for the building.

CHIHUAHUA, MEX.—The State government has granted to Manuel Gameros and Alberto Terrazas, both of this city, a general concession for the development of hydro-electric power in the district of Iturbide, which includes this capital.

CHICO, CAL.—Another step by the Sacramento Valley Power Company, in its declared intention of delivering electricity for power and lights in Chico early next year was taken this week when the company acquired a franchise for carrying on business in Chico.

POMEROY, WASH.—The property of the Tucannon Power Company has been purchased by C. L. McKenzie of Colfax. McCroskey & Riggs of this place are also interested to a slight extent. Books and accounts will be kept in Colfax. It is reported that many improvements will be made.

SANTA ROSA, CAL.—H. C. Eastman's bid of $250 for a franchise to run a line for the purpose of conducting electric light and power from Sebastopol to Graton, Forestville, Occidental, Camp Meeker, Guerneville, and other places in Western Sonoma has been accepted by the Board of Supervisors.

PORTLAND, ORE.—Michael Earles, president of the Hanford Irrigation and Power Company, has obtained a controlling interest in the stock of that company, thereby blocking the attempt of Robt. E. Strahorn, president of the North Coast Railway, to purchase the big land and power holdings of the corporation on the Columbia River. The value of these holdings is placed at $3,000,000. Many improvements are planned and a bond issue of $500,000 has been arranged for to permit the enlargement of the company's power plant at Priest Rapids and the construction of additional canals and pumping plants.

TELEPHONE AND TELEGRAPH.

SAN FRANCISCO, CAL.—All the wires of the Pacific States Telephone Company, in Alameda will be placed in underground conduits.

LAMONT, WASH.—At a meeting of business men, held recently it was decided to take over the local telephone system. W. R. Hegler is the owner. The company will incorporate with a capital stock of $2500.

SANTA ROSA, CAL.—An application for an electrical franchise and for permission to erect poles and lines for carrying electric current, telephone and telegraph wires, has been presented to the Board of Supervisors.

MONROE, WASH.—The Commercial Club has secured the promise from the Independent Telephone Company to construct a telephone line up the Snoqualmie valley from this place to Fall City upon the sale of $2500 of the bonds of the company here.

KENNEWICK, WASH.—The White Bluffs & Columbia River Telephone Company, with Fred M. Weil as president, has completed arrangements for entering every division of the valley opening central stations. The system will be extended ultimately to North Yakima and Prosser.

ILLUMINATION.

ALTURAS, CAL.—The Alturas Electric Light & Power Company has had a survey made of the water power in Modoc county.

BEND, ORE.—Louis Deener of Princeville, vice-president and manager of the Pioneer Telephone & Telegraph Company, has applied to the City Council of Bend for a franchise to install an electric light and power plant in this place and sell electricity for lighting and power purposes.

YUBA CITY, CAL.—The work of constructing the electric line that will furnish light and power for Sutter City, Meridian and the country intervening west of this city was commenced last week. The Pacific Gas & Electric Company expects to have the line installed within 60 days and ready to serve the patrons by January 1.

RENO, NEV.—An officer of the Reno Power, Light and Water Company gives out the information that in a short time the company will commence the construction of a $1,000,000 plant west of Reno, on the Truckee River, in order to increase the power furnished by the company. Most of this power will be transmitted to mining camps in different parts of the State.

TRANSPORTATION.

PHOENIX, B. C.—It is reported that the Canadian Pacific will electrify its branch into Phoenix.

NELSON, B. C.—The Nelson Street Railway Company is taking steps to begin work on the system for this place.

CHEHALIS, WASH.—A. J. McCabe of Portland has been awarded the contract for grading the electric line that will connect Chehalis and Centralia.

GLENDORA, CAL.—Surveyors under the direction of Chief Engineer Pillsbury of the Pacific Electric Railway, are running a line from here to San Dimas stone quarry.

ALBION, IDA.—E. J. Hunter has returned from a trip to Chicago, where he financed the Albion Interurban Railway from Burley to this place. The road will cost $250,000.

EUREKA, CAL.—At a meeting of the Committee of the Whole of the City Council, George Henderson, through his attorney, Charles P. Cutten, asked for a franchise for an electric railroad to run up F street from the waterfront to the city limits.

SAN DIEGO, CAL.—The Common Council has taken final action on an ordinance granting two franchises for street railway lines to San Diego Electric Railway Company.

RENO, NEV.—Surveys have been completed for an electric railway connecting Ely, East Ely, Smelter, Riepetown and the mines of Ely, and construction work will soon commence. G. L. Rickard is president of the company.

BOZEMAN, MONT.—It is announced that R. M. Hart of Spokane has secured the controlling stock of the Gallatin Valley Electric Railway. The project of extending the road to Three Forks in the spring is now under consideration.

MERIDIAN, CAL.—The steamer Red Bluff has unloaded about 400 piles to be used as power poles for the new power line now under construction along the right of way of the Northern Electric Railroad from Meridian to Yuba City.

KENT, WASH.—Thomas Chapman of O'Brien and Henry Madison of Kent, have been placed on the committee to incorporate for the purpose of raising $100,000 and securing right of way for an electric line from Kent to Renton to connect with the Seattle, Renton & Southern line.

STOCKTON, CAL.—The application for a franchise over Front street in Lindon has been filed by the officials of the Stockton and Jenny Lind Interurban Railroad, and at the next meeting of the City Council the usual request for a franchise over streets inside of the city limits will be filed.

PRINEVILLE, ORE.—County Surveyor Fred A. Rice has the contract for the completion of a survey for an electric road from Opal City, the new town on the north side of Crooked River, located on the Oregon trunk and Harriman line surveys, to Prineville by way of Lamonta gap and McKay plat.

BELLINGHAM, WASH.—It is reported that the bonds for the Nooksack Traction Railway Company, which is planning the construction of a network of interurban lines have been floated, and it is announced by J. E. Morrison, the promoter, that work will shortly begin and that terminal buildings will be erected here to cost $30,000.

VALLEJO, CAL.—T. T. C. Gregory, attorney for the Vallejo & Northern electric road, which is to be operated between this city and Sacramento when finished, has taken preliminary steps to institute condemnation proceedings against the Houghton estate over tide land survey No. 3, that they may gain an entrance by circling the water's edge into this city.

PENDLETON, ORE.—The Umatilla Railway, Light & Power Company of this place has made preliminary surveys to erect a line from the south end of Umatilla county north to the Columbia. The completed line will tap a large farming country and cost about $1,500,000 to build. Douglas Belts is president of the company and G. A. Brown, vice president.

GLENDALE, CAL.—The City Trustees have received a communication from the Pacific Electric Railway Company stating that it would not construct a road on the street from Brand to Glendale avenue, for which a franchise was granted some two years ago. The company added that if the Trustees will repeal the section concerning transfers it will assign the franchise to the Glendale and Eagle Rock Railway Company.

SPOKANE, WASH.—Adolph F., Edward H. and Oswald N. Suksdorf of Spokane, have incorporated the Columbia River and Mount Adams Railroad Company with a stated capital of $2,000,000. The company has plans to build a railroad with branches from a point on the Columbia River in Klickitat County, Wash., northerly through parts of Klickitat, Yakima and Skomania Counties to Mt. Adams in the two latter counties. It will also operate steamboats and ferries on the Columbia River, generate electric current for light and power purposes, mine coal and handle timber.